Gluisax: Bent Leather Band's Augmented Saxophone Project

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ABSTRACT
This demonstration presents three new augmented and meta saxophone interface/instruments, built by the Bent Leather Band. The instruments are designed for virtuosic live performance and make use of Sukandar Kartadinata's Gluion [OSC] interfaces. The project rationale and research outcomes for the first twelve months is discussed. Instruments/interfaces described include the *Gluisop*, *Gluialto* and *Leathersop*.

Keywords
Augmented saxophone, Gluion, OSC, virtuosic performance systems

1. INTRODUCTION
The Bent Leather Band is currently undertaking its Sonic Frontiers residency at Victoria University's Centre for Telecommunications and Microelectronics [Melbourne]. The ensemble was formed to develop new instruments and new music for the virtuosic live performance. So far, the project has developed a number of unique and versatile instruments including light-harps and electronic leather bassoons. The project has been developing over a long term [15 years] and research has been undertaken concurrently with artistic activities including; concerts, exhibitions and recordings. Research projects have investigated a number of areas including; musical languages [*Free music*, Indian music *gamaka*, micro-tonality and multi-phonics], interface design, live signal processing, performance techniques, virtuosity, feedback systems and skilled performance.

The project has sought to develop mature instruments from working prototypes, *playable instruments*. We define *playable instruments* as expressive, responsive, versatile and practicable: suitable for technical and musical development. The project has also aimed to develop instruments that are intuitive, inspiring and capable of demonstrating their own sound and personality. Additionally the project has focused on live improvisation and since the Paris NIME, has been joined by a number of new musicians in order to develop new interfaces or extend their own acoustic instruments with sensors, sound interfaces and software. The project has been working with *gluion* streaming interfaces [5], with the idea of forming a large ensemble of networked *playable* instruments. This demonstration presents work undertaken with three saxophone players, Tony Hicks, Dale Chant and Paris Favilla, to develop extended saxophones for this larger ensemble. Other musicians have contributed also, including Derek Pascoe from the University of Adelaide.

2. BACKGROUND
When embarking on this project, we were conscious that the saxophone has had quite a history of modification and use in electronics. After all, it was Daniel Kientzy's Computersax [6] work in the late 1980's early 1990s, that served as an initial inspiration for us to head into signal processing. Braxton and Rosenboom's live interactive CD was a favorite for a while and even local Melbourne musicians such as Brian Brown were experimenting with leather saxophones and effects machines. Digital controllers by Yamaha, the EWIs, and Syntaphones all belong to a MIDI generation and together, with many other experimental interfaces are well beyond the scope of this demo for critical review.

Meta, augmented and hybrid instruments, there are so many now. Strings, percussion and brass instruments are well represented here, but the saxophone perhaps not enough. Even Sukandar's gluions have featured on at least three meta/Mehta trumpets [Axel Dörner, Jonathan Impett and Rhajeesh Mehta] and there are a number of trombone projects such as Nic Collins, and LeMouton [7]. The work of Matthew Burtner and his Metasax would be the best-known augmented sax controller in recent times.

His approach of placing sensors over existing saxophone keys to affect expression while playing long notes, brings into sharp focus the issues of redundancy of saxophone technique and interface. Burtner's musical landscape takes the saxophone well outside the instrument's traditional jazz and repertoire boundaries into a space that redefines timbre. Burtner explains his approach as a modification of the keys, situating force-sensitive resistors under the finger-tips to affect "after-touch". He writes; "…In essence, the saxophone keys which normally execute only on/off changes of the air column, are converted to continuous control levers…"[1].

The saxophone is amongst a number of highly specialized traditional instruments bristling with key-work. Instruments that keep your fingers busy while you hold onto it as best you can. It is arguable that this co-dependency of the Meta-sax's traditional acoustic and electronic sensor interfaces has transformed the instrument's nature entirely. To progress this idea further, an *after-touch* saxophone may not even need any keys. Instead it could perhaps be better served bristling with sensors; which is how the third of our bassoons *contra-monster* was conceived. Sensors were placed under the first three [strong] fingers for both hands with joysticks situated for the thumbs. The instrument is capable of ten channels of simultaneous control. However, the contra-monster was constructed via a number of prototypes and also to perform a specialized signal processing based musical language.

Schiesser and Traube's saxophone project [8] offers a more practical solution regarding this issue. Their augmented saxophone's electronic sensors were situated for simultaneous and independent actuation alongside the traditional saxophone key work, allowing the musician to still play conventionally and yet execute independent sensor control. Their USB interface instrument was limited to only six 10-bit analogue controllers [force sensitive resistors or FSRs, inclinometers and ultrasound proximity] and some buttons. Nevertheless it demonstrates some practical features including a control panel mounted on the right hand side of the bell.

Some other points worth mentioning here are that larger acoustic instruments usually require bigger hand stretches and that there are other places for sensors to go on the saxophone if the instrument is supported well and the thumbs are free to move.

Perhaps there is a way to augment the saxophone without any redundancy of technique, interface etc? Can the acoustic and electronic interfaces be independent of each other and also be effective? What about bending notes and other techniques that are not so on/off? Finally, what about a leather saxophone i.e. a sensor only instrument? These questions formed the basic parameters for our project and we decided to make a number of *playable* OSC saxophones in collaboration with the musicians.

3. GLUISOP

Amongst the saxophonists involved in the project, there remained a strong interest in developing a small, portable extended saxophone. Touring and air freight issues were the main consideration here. But also smaller instruments, well supported by neck-straps, allow for the weight of the instrument to be taken off the thumbs, potentially freeing them to play sensor controls. For these reasons we chose a *bent* soprano as our first instrument to work with and in collaboration with the saxophonists developed a sensor interface consisting of two panels.

The first panel mounted a number of dials, switches and FSRs and was situated on the right hand side of the saxophone's bell.

Figure 1. *Gluisop*

The second panel, which was much smaller, mounted a joystick, two dials and one small FSR for the left hand. The instrument was completed with an extra FSR at the lower right-hand thumb-rest.

Figure 2. Gluisop left-hand panel

Two microphones were used to pick up the instruments sound, one clipped on to the bell and another one over the key-work to pick up key clacks and other techniques. The microphone signal was digitized by a Digidesign 002 audio interface.

The sensors were digitized using a gluion *sneaker* interface with sensors cabled [soldered] onto pins, allowing them to be connected directly into the interface housings high density SUB-D connector. Analogue sensors are sampled at 16bit resolution and OSC data streamed directly into MaxMSP with up to a 1 msec refresh rates. With the instrument supported by a neck-strap the musicians could play the saxophone's key-work unrestricted and still have at their disposal up to four independent channels of simultaneous sensor control. Situating a joystick at the lower thumb rest extended this further to five.

Dials of various sizes and types were used on the instrument for specific purposes. For the transposition of pitch, or delay-time [fine control] a large dial capable of small, well-controlled movements was situated on the right-side panel. Roller dials have been positioned for thumbs, while FSRs have been nested for the small "pinky" finger to control feedback of delays and comb filters. The gluion is directly connected to the computer using a standard Ethernet network cable.

3.1 Gluialto & Leathersop

Two other saxophones were also constructed for the project. The *Gluialto* was constructed in conjunction with Dale Chant and was interfaced to a 16bit *Gluion Slipper* interface. This interface stacked another joystick on the left hand panel and added two extra FSRs.

Finally the *Leathersop* [leather soprano sax], was developed as a new instrument for the bent leather collection but also as a total sensor saxophone. Similar to the *Contramonster*, [3] this instrument has no open tone holes and places sensors instead onto the closed tube. This instrument has eight FSRs and two joysticks for the hands to play allowing for up to 12 simultaneous channels of sensor control. The *Leathersop* also has a number of dials and switch based controllers and can be used with either a continuous foot-pedal or active electromagnetic proximity sensor [expressive radius of up to two meters]. *Leathersop's Gluion* electronics make use of Sukandar's new smaller circuit board and are built in to the instrument's body.

4. MAPPING AND PERFORMANCE TRIALS

The saxophones' preliminary mappings have been based on the bent leather band's contra-monster work and developed by Joanne Cannon. This software patch developed in Max MSP brings together a granular pitch shifter, a smooth pitch delay/echo, a modulation delay patch, two transposable buffer delays [for multi-part playing and comb filtering], and finally a reverb. Each effect is sequenced in their previous mentioned order with one control knob reserved for a wet/dry and global level for stage control etc.

The smooth pitch delay/echo has a nonlinear mapping exploding the range as the delay time approaches zero [for fine pitch control] whereas at the other end of the delay time the range is confined discretely to control the buffer size for rhythmic looping and re-sampling. The two transposable buffer delays have a pitch range of over eight octaves. The mapping was developed as an expressive, intuitive solution for a number of joysticks, wheels and FSRs.

At this stage of the project the majority of trial performance work has been done with the Gluisop instrument, [consisting of regular rehearsals over a six-month period. During this time, the instrument was secured to an adjustable stand taking all of the weight off the hands. Another dial controller was added to the left-hand panel just above the joystick. The FSR on this panel was repositioned between the underside of the panel and the left-hand upper thumb rest of the instrument so that any downward pressure applied to the dials or joystick of this panel could be transferred independently as another channel for control.

These modifications and the inclusion of the stand, made the instrument much easier to play. Although some sensor controllers such as those situated on the lower panel, still require the right hand to come off the instrument's key-work. Although, the sensors and saxophone keys remain independent and the instrument is capable of the full gamut of saxophone technique in performance with four simultaneous channels of sensor control.

figure 3 and 4. Tony Hicks and *Gluisop*

Furthermore, all saxophonists involved in the project found that the instrument could be picked up and played without a detailed knowledge of the signal processing techniques involved. Once the mapping was set up the instrument was intuitive to the player. New sounds and techniques have been discovered in each of the following sessions also and the development of advanced techniques continues. The mapping and sonic outcomes are also compatible with the Bent Leather Band's existing ensemble language so the *Gluisop* has been brought into the group.

Fig. 4 & 5. Gluialto metasax [bent leather band 2008]

This instrument, although not capable of as many simultaneous channels of control as the *Leathersop*; introduces the main ideas of signal processing expression such as, delay time [dial] and feedback [FSR or pressure] control, the use of two dimensional joystick controllers and global parameter settings and controls. Therefore it also serves as a training instrument for the more advanced *Leathersop* sensor interface as well as an instrument in its own right.

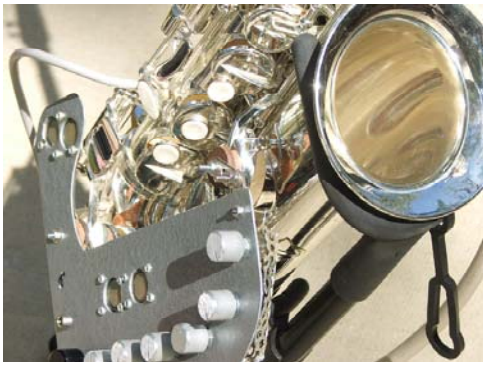

Fig. 6 Gluialto metasax

5. NEXT STEPS

The next stage of the project involves building the ensemble up and networking interfaces to a single computer. The Bent Leather Band project "Heretics Brew" aims to develop an ensemble of experimental instruments/interfaces for brass, saxophones, woodwinds and guitar families. The project is building momentum and in the process of staging public performances and recording with Tony Hicks, Dale Chant, Paris Favilla and Melbourne experimental improviser and guitarist Ren Walters.

The project team has also presented the instrument at the University of Adelaide where experimental saxophonist Derek Pascoe and composer Luke Harrald have been working on live multi-agent performance systems for saxophone. Luke has expressed an interest in writing for the ensemble and it is anticipated that the new instrument projects will be completed in 2008. New mappings and signal processing techniques including tuning systems and spatial projection control will also be trialed.

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